

**CONTROL  
TECHNIQUES**

**UNIDRIVE M SERIES**

# HIGH POWER MODULAR AC DRIVES

**M600/700/701/702**



**Highly reliable drive  
modules allowing flexible  
system design with  
rapid global support**

**SCIENCE  
GATE**  
Your Automation Partner



**SCIGATE AUTOMATION (S) PTE LTD**

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Business Hours: Monday - Friday 8.30am - 6.15pm

90 kW to 2.8 MW  
125 hp to 4,200 hp  
200 V | 400 V | 575 V | 690 V

**Nidec**  
All for dreams

# Control Techniques Solving your challenges

## Nidec – the world’s No.1 comprehensive motor manufacturer

Nidec Corporation was founded in Kyoto, Japan in 1973 by four engineers. Today we have operations in over 40 countries through approximately 300 companies, employing 110,000 people. Our vision has always been to be the world’s number 1 for everything that spins and moves. From small precision to supersized motors; we create next-generation drive technology that accommodates the needs of the society.

## Control Techniques – a global drives specialist

Control Techniques have been at the front of customer-focused drive technology for over 45 years. We’re dedicated to the advancement of automation. From product development at our headquarters to our 26 automation centers, we provide solutions relevant to the industries in your region. We ensure high performance, reliability and energy efficiency across every application.



**115,000**  
Employees worldwide



**1,500+**  
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**220 MANUFACTURING LOCATIONS WORLDWIDE**

Producing a comprehensive range of high quality products, optimized for industry-specific customer requirements



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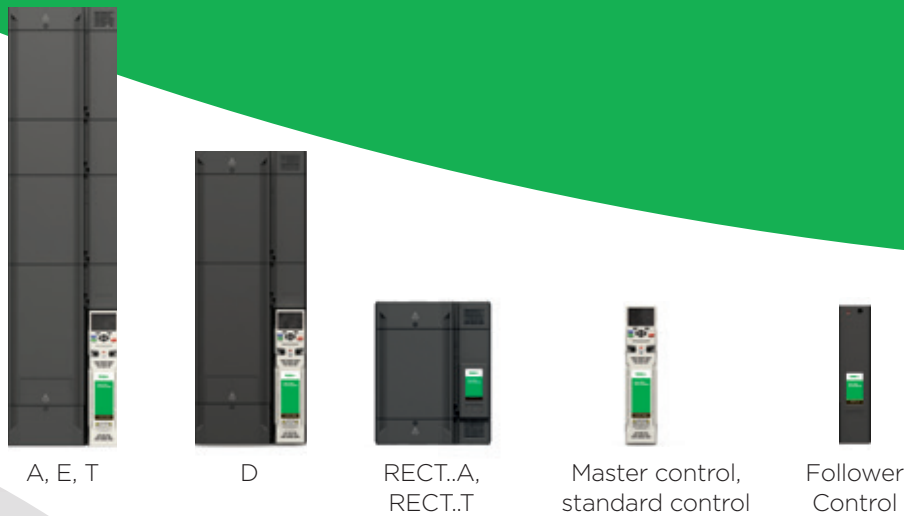
# Unidrive M

## High power modular drives

Unidrive M's modular offering provides a flexible method of building compact, reliable high-power solutions. Paralleled together, Unidrive M can control asynchronous and permanent magnet motors in systems up to 2.8 MW (4,200 hp). The frame 11 is a 250 kW (400 hp) module that allows system builders to create high power solutions with the smallest number of components, keeping both footprint and costs to a minimum.

Unidrive M differentiates itself on performance with extremely fast current control algorithms and high switching frequencies. Active Front End (AFE) solutions deliver unparalleled torque precision and power quality.

The Unidrive M modules can be paralleled into a wide range of flexible solutions to solve all system needs including Active Front End and multi-pulse rectifier configurations. They can be controlled by M600, M700, M701 and M702 controllers.



Format	
A	AC in AC out module with integrated rectifier and line choke. Available in frame size 9 and can be paralleled up to 1.9 MW (Unidrive SPMA replacement)
E	AC in AC out module with integrated rectifier. Available in frame sizes 9, 10 & 11 and can be paralleled up to 2.8 MW
T	AC in AC out module with 12 pulse integrated rectifier. Available in frame size 9, 10 & 11 and can be paralleled up to 2.8 MW
D	DC in AC out module. Available in frame size 9, 10 & 11 and can be paralleled up to 2.8 MW (Unidrive SPMD replacement)
RECT..A	AC in DC out rectifier 6 pulse module (Unidrive SPMC replacement)
RECT..T	AC in DC out rectifier 12 pulse module (Unidrive SPMC2 replacement)
Standard Control	M700, M701, M702, M600 controller for single module systems
Master Control	M700, M701, M702, M600 master controller for systems with more than one module
Follower Control	Follower controller for all paralleled modules



# Reliable and flexible High performance solutions



## Minimize downtime for critical operations

We know how important reliability is to our customers and that every second of system downtime can be costly. Unidrive M high power modules have exceptional build quality based on over 45 years of drive knowledge, expertise and development. Built using world leading manufacturing processes, the modules are packed with features proven to keep Unidrive M running in the most testing of environments. Control Techniques Automation Centres are situated in many global regions to provide local design consultation and rapid specialist technical support wherever your business is located.



## Reliability assured

- Every Unidrive M power module has been thoroughly tested in environmental chambers that cycle a wide range of load and thermal conditions
- PCBs have conformal coating to further increase resilience to harsh environmental conditions
- Trip avoidance features take intelligent action instead of interrupting critical processes.

For example:

- Active thermal monitoring reduces switching frequency as the drive approaches thermal limits
- Load shedding reduces speed at current limits
- Supply loss ride-through keeps the drive running during supply brown outs
- Protection alarms safeguard the wider system (e.g. over current, over temperature, over voltage and short circuit protection)
- Intelligent variable speed fans ensure operating temperature stays within limits. They are easily replaceable as part of routine maintenance
- Wide supply voltage tolerance keeps drive operation smooth in areas where supplies are variable





### Create flexible systems easily

The modular approach to building high power systems provides machine builders with flexibility while keeping complexity low. Modules with integrated rectifiers and / or line chokes can be easily paralleled keeping installation time and component count to a minimum. Separate inverter and rectifier modules (D, RECT..A and RECT..T) can be paralleled into more flexible common DC bus and regenerative configurations where power management and system design efficiency are key.

#### Flexible and easy system design:

- Unidrive M high power modules are designed to fit in standard 600 mm deep x 400 mm wide (23.6 x 15.7 in) cubicles
- 6,12,18 and 24 pulse input and Active Front End configurations are easy to achieve
- Integrated cooling fan power supply means no additional power supplies are required
- Output current ratings have been increased to use fewer modules per system
- A common control interface ensures a consistent programming method and feature set across the whole Unidrive M range. Familiarity reduces the need for training:
  - Identical parameter structure with Smartcard and SD card cloning support
  - Connect software for monitoring, diagnostics and parameter file management
  - Machine Control Studio for application programming in IEC61131-3 environment
  - SI-Option module support for additional I/O and fieldbus (e.g. Ethernet/IP, PROFINET RT, EtherCAT, PROFIBUS)
  - MCi and SI-Applications modules for advanced application solutions

### Make compact, easily maintainable systems

- Unidrive M high power modules are incredibly compact given the impressive amount of power they can deliver. For example, the powerful AC in AC out 250 kW (400 hp) module measures only 1242 x 310 x 312 mm (48.9 x 12.2 x 12.3 in) - a power density unrivalled in the market place and almost half the size of other leading suppliers.
- Overall system size and footprint is kept to a minimum
- Manageable small and light modules are maintained and replaced rapidly and easily

### Reduce spares inventory

Unidrive M's modular approach gives customers the opportunity to standardize their solutions in order to keep spares holding to a minimum as different systems can be serviced using one common spare. Additionally, large volumes of standard product modules are stocked at local distribution hubs in convenient locations around the world meaning that rapid delivery is always available to all customers.

### Upgrade Unidrive SP modular systems painlessly

Migration of Unidrive SP modular systems to Unidrive M is fast and easy with many conversion tools available:

- Parameter porting tools such as Connect and Smartcard are available
- SyptPro can recompile SM-Applications programs for SI-Applications and connect to existing CTNet networks
- Identical width and depth dimensions, along with retrofit kits, mean that Unidrive M modules can easily fit into SP modular locations using existing fittings

### Environmental safety and electrical conformance

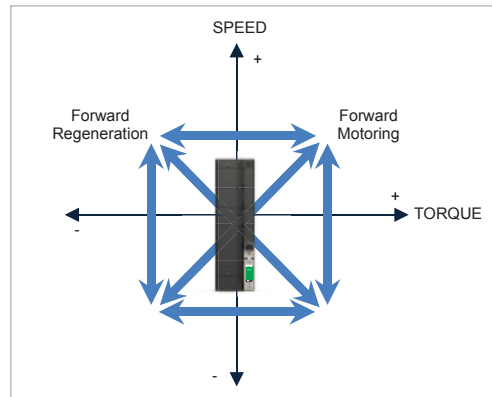
- UL listed
- Electromagnetic immunity complies with EN 61800-3 and EN 61000-6-2
- Electromagnetic emissions comply with EN 61800-3
  - On-board EMC filter, category C3
  - Optional external EMC filter, category C2 depending on power rating
  - Compliance with EN 61000-3-12 with external line reactor

## Create high performance solutions

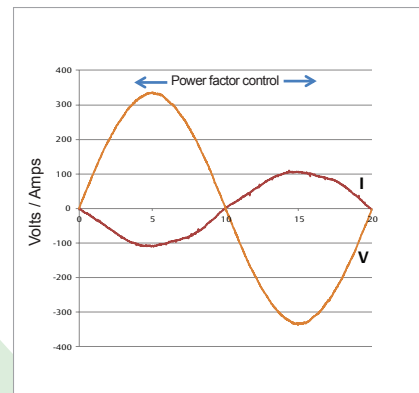
Unidrive M delivers market leading control performance at high powers with extremely fast current control algorithms, advanced thermal monitoring and high switching frequencies. When Unidrive M power modules are configured with an Active Front End, dynamic torque response can be effectively demanded across all power quadrants.

- Switching frequencies of up to 16 kHz in systems up to 160 kW (250 hp) and 8 kHz in systems up to 250 kW (400 hp) allow Unidrive M to provide precision torque. This is effective in demanding applications such as test stands, where our ETPS solution (engine torque pulsation system) can precisely simulate dynamic engine torque profiles.
- Highly accurate thermal model ensures:
  - High overload capability - 150% Heavy Duty
  - Impressive low derating requirement in applications that demand high torque at low speeds. Power device temperature is intelligently managed meaning smaller lower priced systems can be specified and product life is extended.
- Dynamic Active Front End configurations provide:
  - Precision torque linearity across quadrants
  - Corrective power factor operation (lagging, unity or leading) for high quality power
  - Harmonic mitigation

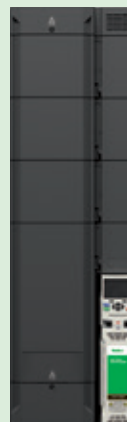
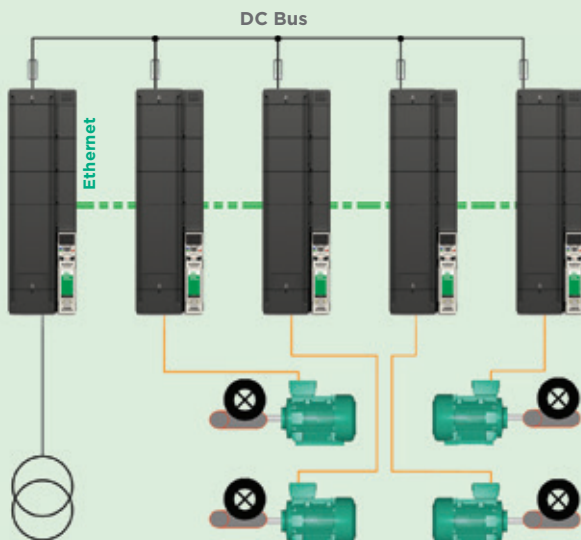
## Dynamic response across 4 quadrants



## Superb power quality management



## Example of a highly demanding automotive test stand application

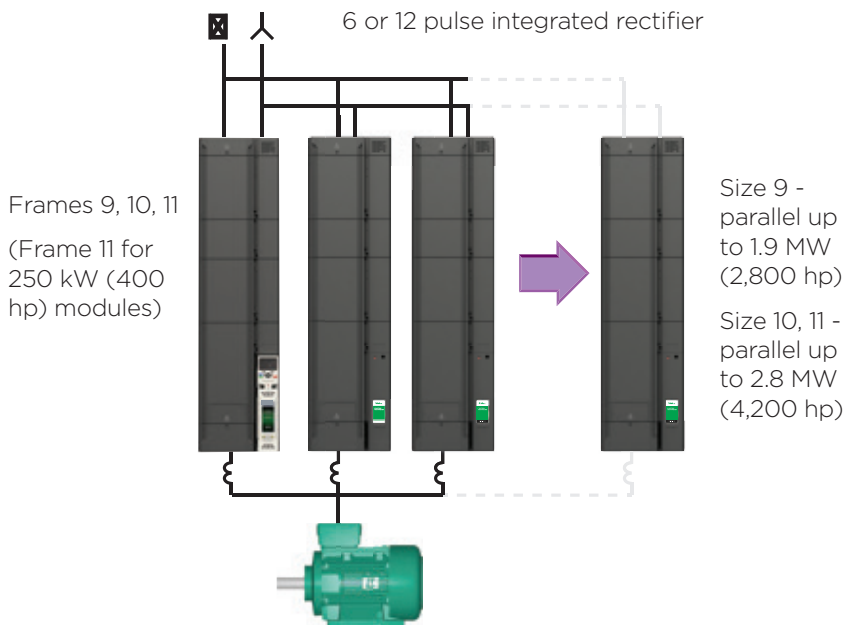


# Module configurations and order information

## 'A', 'E' & 'T' - AC in AC out modules

Unidrive M's AC in AC out modules are available in 3 frame sizes (9, 10, & 11) and comprise an integrated 6 or 12 pulse rectifier with an inverter. 'A', 'E' and 'T' formats can be paralleled together to reach powers of 2.8 MW (4,200 hp) and can be supplied with an optional braking transistor. Frame 9 has an internal choke version that can be paralleled to 1.9 MW (6 pulse only).

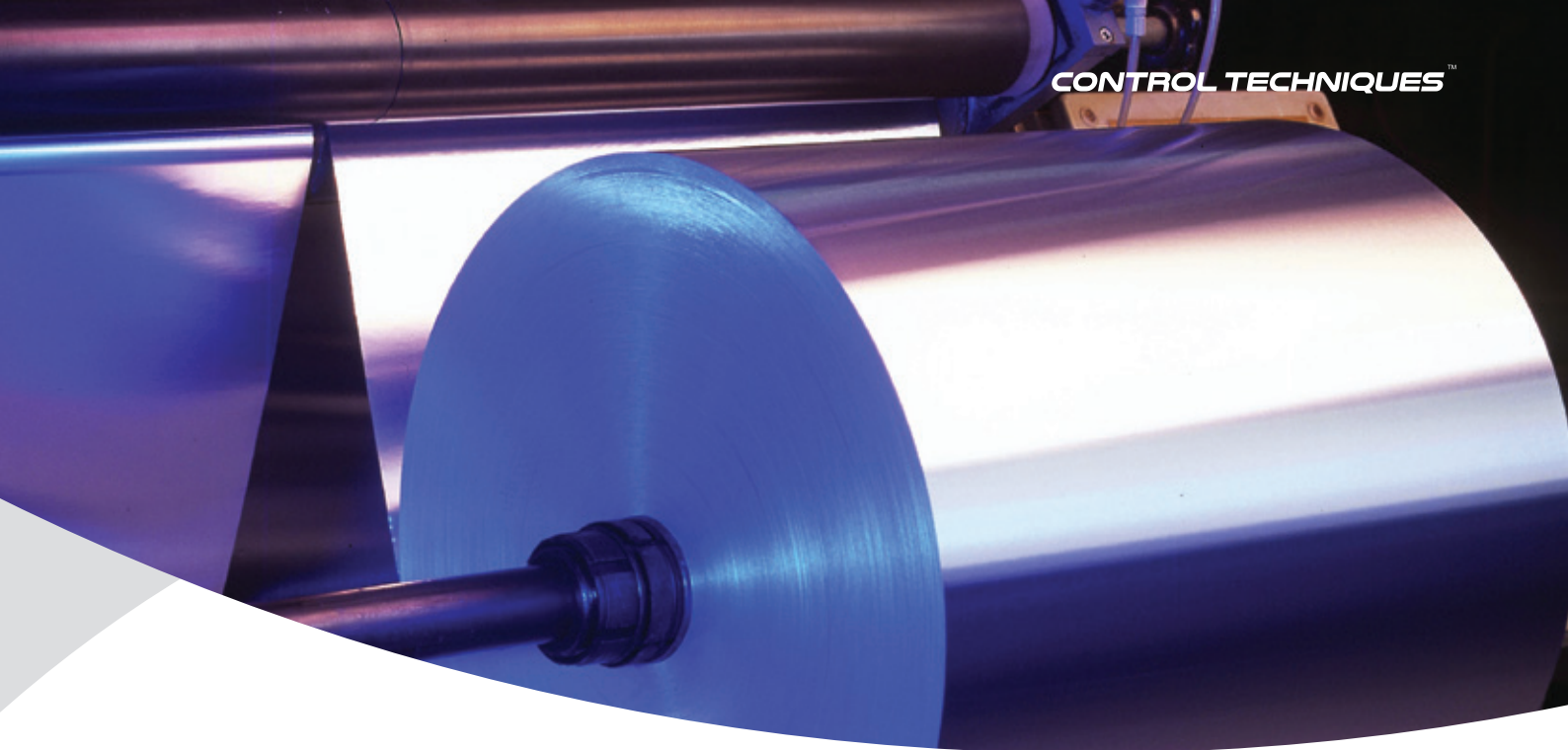
### Example using 'T' format with 12 pulse rectifier.



The above system is simply configured by ordering:

Component	Quantity	Part number
'T' format power module (integrated 12 pulse rectifier with inverter)	Quantity of frame 11 modules required is: total power required / 250 kW - derating (see technical manual)	M000-114040640T10100AB100
Control standard	In systems with only 1 'A' 'E' or 'T' module, use 1 standard control	M700-STANDARD00011100A0100
Control master	In systems with >1 'A' 'E' or 'T' module, use 1 master control	M700-MASTER00011100A0100
Control follower	1 for each paralleled module (1 less than the total number of modules)	M000-FOLLOWER00011100A0100





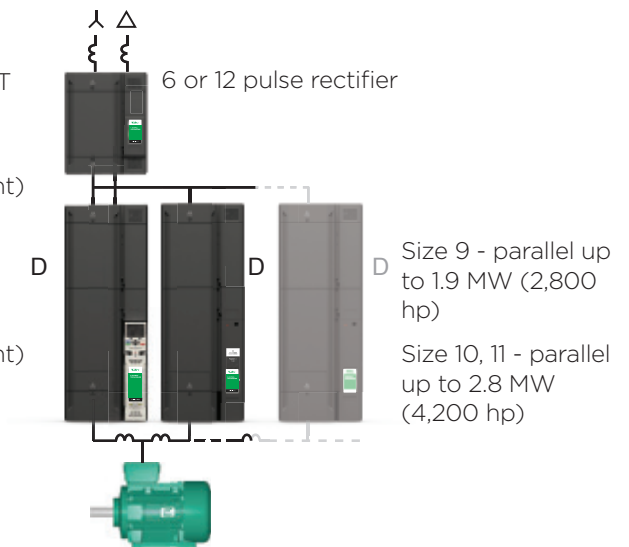
### 'D' - DC in AC out modules with RECT..A and RECT..T Rectifiers

Unidrive M's DC in AC out modules are available in 3 frame sizes (9, 10, & 11) and can be configured as either output or active input stages of a system. 'D' modules can be paralleled together using a common DC bus to reach powers of 2.8 MW (4,200 hp).

### Example using 'D' format to parallel power

RECT..A or RECT..T  
Size 10 or 11  
(depending on power requirement)

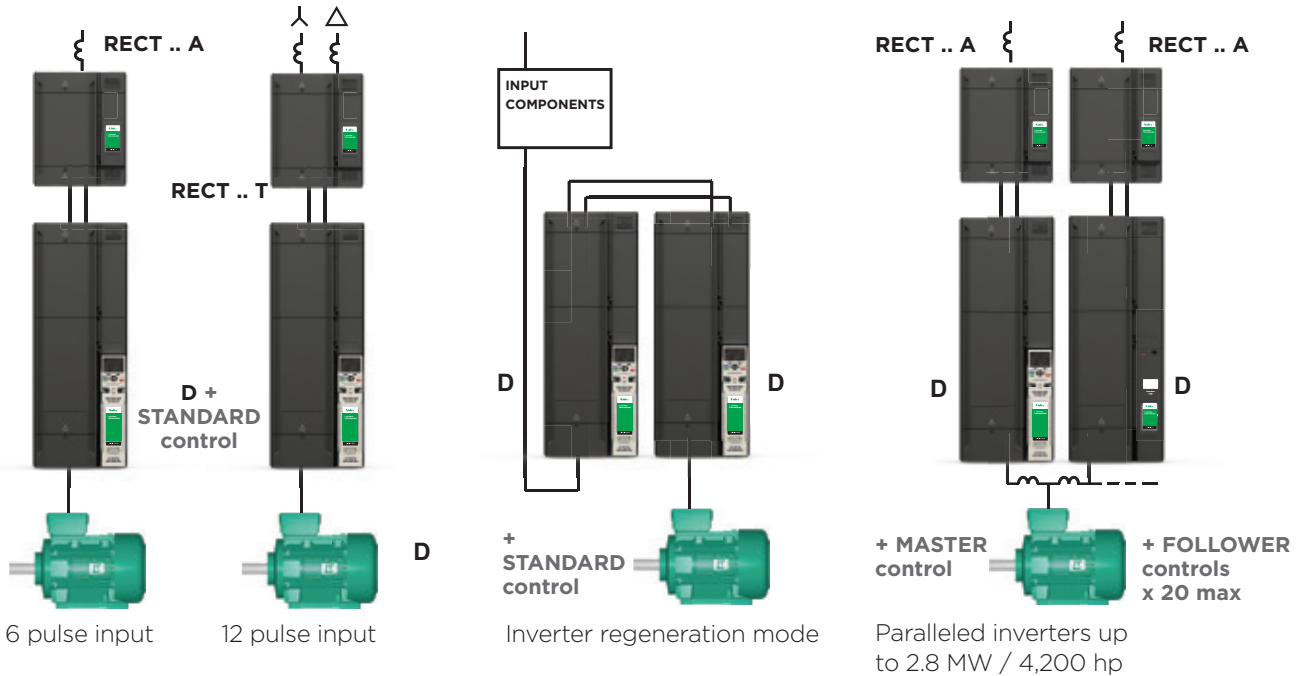
'D' inverter  
Size 9, 10 or 11  
(depending on power requirement)



The above system is simply configured by ordering:

Component	Quantity	Part number
Rectifier RECT..A or RECT..T size 10 or 11 depending on power required	1 (add more as system power increases)	RECT-114042x406T10100AB100
'D' format inverter module size 9, 10 or 11 depending on power required	1 (add more as system power increases)	M000-114040640D10100AB100
Control standard	In systems with only 1 'D' inverter, use 1 standard control	M700-STANDARD00011100A0100
Control master	In systems with >1 'D' inverter, use 1 master control	M700-MASTER00011100A0100
Control follower	1 for each paralleled module (1 less than the total number of modules)	M000-FOLLOWER00011100A0100




Other flexible configurations with 'D' modules



- Frame 9:      90 to 110 kW / 125 to 150 hp HD
- Frame 10:      132 to 160 kW / 200 to 250 hp HD
- Frame 11:      185 to 250 kW / 300 to 400 hp HD

# Integrate, automate, communicate with Unidrive M options

Unidrive M drives support a wide range of optional click-in System Integration (SI) modules that allow them to integrate seamlessly with existing automation systems and other vendor supplied equipment. These include communications, I/O, feedback devices, enhanced safety features and onboard PLCs.

Option		Description
<b>System Integration Modules</b>		
MCI200		Second processor, providing advanced machine control using Machine Control Studio.
MCI210		Adds to the MCI200 with a dual port Ethernet interface directly on the processor and additional I/O.
SI-Applications		Second processor module, which allows SyPTPro application programs to be re-compiled for Unidrive M700.
SI-Safety		An intelligent, programmable module to meet the IEC 61800-5-2/ISO 13849-1 functional safety standard up to SIL3/PLe.
SI-Ethernet		Ethernet module supports EtherNet/IP and Modbus TCP/IP.
SI-EtherCAT		EtherCAT interface module.
SI-PROFINET RT		PROFINET RT interface module.
SI-PROFIBUS		PROFIBUS interface module.
SI-CANopen		CANopen interface module.
SI-DeviceNet		DeviceNet interface module.
SI-Universal Encoder		Encoder input and output interface supporting Quadrature, SinCos, HIPERFACE, EnDat and SSI encoders.
SI-Encoder		Quadrature encoder input interface module.
SI-I/O		Extended I/O interface module to increase the number of I/O analog and digital points on a drive.
<b>Drive Interface Units</b>		
Smartcard		Smartcard memory device to back-up and copy parameter sets and basic PLC programs.
SD Card Adaptor		Allows an SD card to be inserted into the Smartcard slot, for parameter back-up cloning and application programs.
KI-485 Adaptor		Allows the drive to communicate via RS485.
CT USB Comms cable		The USB Comms cable allows the drive's RS485 port to connect to a PC for use with Unidrive M's PC tools.
<b>Keypads</b>		
KI-Keypad		Plain text, multilingual LCD keypad with up to 4 lines of text for in depth parameter and data descriptions, for an enhanced user experience.
KI-Keypad RTC		All the features of the KI-Keypad, but with battery operated real-time clock. This allows accurate time stamping of events, aiding diagnostics.
Remote Keypad		Remote mountable, plain text, multi-language LCD keypad allows flexible mounting on the outside of a panel and meets IP66 (NEMA 4).
Remote keypad RTC		The keypad is remote mountable, allowing flexible mounting on the outside of a panel (meets IP54/ NEMA 12). Three line plain text, multi-language LCD keypad for rapid set-up and helpful diagnostics. Battery operated real-time clock allows accurate time stamping of events, aiding diagnostics.

# Unidrive M frame sizes and ratings

## INTEGRATED INVERTER & RECTIFIER

### MODULAR DRIVES









Frame size		9A	9E   9T	10E   10T	11E   11T
Frame sizes available	M600 M700	•	•	•	•
Dimensions (H x W x D)	mm	1049 x 310 x 290	1010 x 310 x 290	1010 x 310 x 290	1190 x 310 x 312
	in	41.3 x 12.2 x 11.4	39.7 x 12.2 x 11.4	39.7 x 12.2 x 11.4	46.9 x 12.2 x 12.3
Weight	kg (lb)	66.5 (146.6)	46 (101.4)   60 (132.3)	46 (101.4)   60 (132.3)	63 (138.9)   65 (143.3)
AC line choke	Internal	•			
	External		•	•	•
Max continuous heavy duty kW rating / A rating	@ 200 V	45 kW - 55 kW (60 hp - 75 hp)	45 kW - 55 kW (60 hp - 75 hp)	75 kW - 90 kW (100 hp - 125 hp)	N/A
	@ 400 V	90 kW - 110 kW (125 hp - 150 hp)	90 kW - 110 kW (150hp)	132 kW - 160 kW (200 hp - 250 hp)	185 kW - 250 kW (300 hp - 400 hp)
	@ 575 V	75 kW - 90 kW (100 hp - 125 hp)	75 kW - 90 kW (100 hp - 125 hp)	110 kW - 132 kW (150 hp - 200 hp)	150 kW - 225 kW (200 hp - 300 hp)
	@ 690 V	90 kW - 110 kW (125 hp - 150 hp)	90 kW - 110 kW (125 hp - 150 hp)	132 kW - 160 kW (175 hp - 200 hp)	185 kW - 250 kW (250 hp - 300 hp)

Modular ratings up to 2.8 MW (4,200 hp) through parallel connected inverters.

DC-AC INVERTER

RECTIFIER

	DC-AC INVERTER			RECTIFIER		
	9D	10D	11D	10A	11A	11T
						
				Single, 6 pulse For frame 9 or 10 inverter	For frame 11 inverter	Twin or 12 pulse for frame 9, 10 and 11 inverter
	•	•	•			
	714 x 310 x 290	714 x 310 x 290	804 x 310 x 312	296 x 310 x 290	383 x 310 x 290	383 x 310 x 290
	28.11 x 12.2 x 11.4	28.11 x 12.2 x 11.4	31.7 x 12.2 x 12.3	11.7 x 12.2 x 11.4	15.1 x 12.2 x 11.4	15.1 x 12.2 x 11.4
	34 (75)	34 (75)	42 (92.6)	12 (26.5)	21 (46.3)	23 (50.7)
				•	•	•
	45 kW - 55 kW (60 hp - 75 hp)	75 kW - 90 kW (100 hp - 125 hp)	N/A	413 A*	N/A	N/A
	90 kW - 110 kW (150hp)	132 kW - 160 kW (200 hp - 250 hp)	185 kW - 250 kW (300 hp - 400 hp)	455 A*	689 A*	2 x 400 A*
	75 kW - 90 kW (100 hp - 125 hp)	110 kW - 132 kW (150 hp - 200 hp)	150 kW - 225 kW (200 hp - 300 hp)	246 A*	387 A*	2 x 380 A*
	90 kW - 110 kW (125 hp - 150 hp)	132 kW - 160 kW (175 hp - 200 hp)	185 kW - 250 kW (250 hp - 300 hp)	251 A*	411 A*	

\* Maximum DC output current

# Hardware selection

## 90 to 250 kW / 150 to 400 hp

Unidrive M high power AC drives provide market-leading current ratings to maximize system capability.

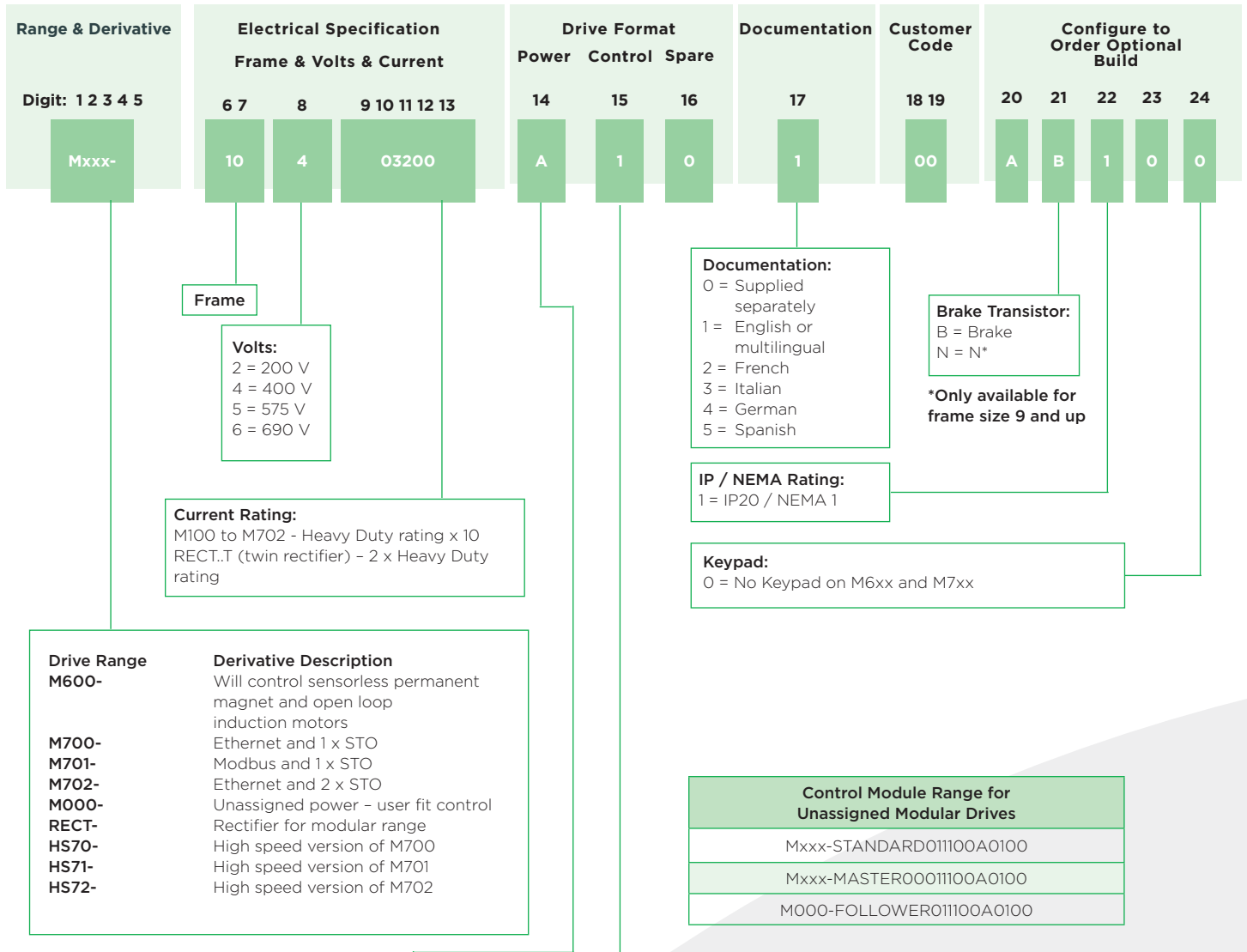
Vac ±10%	M600 M700 M701 M702	Order Code Frame & Format Identifiers	Heavy Duty					Normal Duty					Rectifier for Modular '...D' Inverters	Input Choke		Output Choke	
			I CONT MAX	Motor Shaft Power		I PEAK Open Loop	I PEAK Rotor Flux Control	I CONT MAX	Motor Shaft Power		I PEAK	RECT-...A/T		Single	Dual	Single	Dual
			A	kW	hp	A	A	A	kW	hp	A						
200/240	'-09201760'	09..A/E/ T/D	176	45	60	264	308	216	55	75	238	'-10204100A'	INL401	INL411	OTL401	OTL411	
	'-09202190'	09..A/E/ T/D	219	55	75	328	383	266	75	100	293				OTL402	OTL412	
	'-10202830'	10..E/T/D	283	75	100	424	495	325	90	125	358		INL402	INL412	OTL403	OTL413	
	'-10203000'	10..E/T/D	300	90	125	450	525	360	110	150	396				OTL404	OTL414	
380/480	'-09402000'	09..A/E/ T/D	200*	90	150	300	350	221	110	150	243	'-10404520A'	INL401	INL411	OTL401	OTL411	
	'-09402240'	09..A/E/ T/D	224*	110	150	336	392	266*	132	200	293				OTL402	OTL412	
	'-10402700'	10..E/T/D	270	132	200	405	472	320	160	250	352		INL402	INL412	OTL403	OTL413	
	'-10403200'	10..E/T/D	320*	160	250	480	560	361	200	300	397				OTL404	OTL414	
	'-11403770'	11..E/T/D	377*	185	300	566	659	437*	225	350	480	'-11406840A' '-1142X400T'	INL403L INL403	OTL405			
	'-11404170'	11..E/T/D	417*	200	350	626	729	487*	250	400	535			OTL407			
	'-11404640'	11..E/T/D	464*	250	400	696	812	507*	280	450	558			OTL407			
500/575	'-09501040'	09..A/E/ T/D	104	75	100	156	182	125	110	125	138	'-10502430A'	INL601	INL611	OTL601	OTL611	
	'-09501310'	09..A/E/ T/D	131	90	125	196	229	150	110	150	165				OTL602	OTL612	
	'-10501520'	10..E/T/D	152	110	150	228	266	200	130	200	220		INL602	INL612	OTL603	OTL613	
	'-10501900'	10..E/T/D	190	132	200	285	332	200	150	200	220				OTL604	OTL614	
	'-11502000'	11..E/T/D	200*	150	200	300	350	248*	185	250	273	'-11503840A' '-1162X380T'	INL603		OTL605		
	'-11502540'	11..E/T/D	254*	185	250	381	444	288*	225	300	317			OTL607			
	'-11502850'	11..E/T/D	285*	225	300	428	498	315*	250	350	346			OTL607			
500/690	'-09601040'	09..A/E/ T/D	104	90	125	156	182	125	110	150	138	'-10602480A'	INL601	INL611	OTL601	OTL611	
	'-09601310'	09..A/E/ T/D	131	110	150	196	229	155	132	175	171				OTL602	OTL612	
	'-10601500'	10..E/T/D	150	132	175	225	262	172	160	200	189		INL602	INL612	OTL603	OTL613	
	'-10601780'	10..E/T/D	178	160	200	267	311	197	185	250	217				OTL604	OTL614	
	'-11602100'	11..E/T/D	210*	185	250	315	367	225*	200	250	248	'-11604060A' '-1162X380T'	INL603		OTL605		
	'-11602380'	11..E/T/D	238*	200	250	357	416	275*	250	300	303			OTL607			
	'-11602630'	11..E/T/D	263*	250	300	394	460	305*	280	400	335			OTL607			

**Notes:**

\* At 2 kHz switching frequency

For paralleling, a 5 % derating should be applied. For ratings at F<sub>switching frequency</sub> > 3 kHz (or 2 kHz for F11) refer to User Guide

Refer to electrical specification of the part number (page 15, digits 6-13)



	Power Ident.	Control Ident.	Description	Frame	Power Range (Heavy Duty)	Access to DC bus
M000-	A	U	Integrated Rectifier and Inverter Internal Line Choke	9	90 to 110 kW 125 to 150 hp Up to 1.9 MW / 2,800 hp in Parallel	Yes
	E	U	Integrated Single Rectifier and Inverter External Line Choke	09, 10, 11	90 to 250 kW 125 to 400 hp Up to 2.8 MW / 4,200 hp in Parallel	No
	T	U	Integrated Twin Rectifier and Inverter External Line Choke			
	D	U	DC to AC Inverter	09, 10, 11		Yes
RECT-	A	1	AC to DC Single Rectifier	10, 11	90 to 250 kW / 125 to 400 hp	Yes
	T	1	AC to DC Twin Rectifier	10, 11		

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